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A REVISION OF THE LEPTOPODOMORPHA (HETEROPTERA) OF MADAGASCAR AND NEARBY INDIAN OCEAN ISLANDS

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Abstract.—Previous works on the Leptopodomorpha of Madagascar and nearby Indian Ocean islands are reviewed, keys to genera and species are provided, and the following new taxa are described: *Leptopoides* n. gen. to hold *Leptopus horvathi* Drake and Hottes (type-species) and *Leptopoides poissoni* n. sp.; *Erianotoides oculatus* n. gen., n. sp. (Leptopodidae); *Mascarenisalda* n. gen. to hold *Saldula mametiana* Drake (type-species); *Capitonisaldoida cryptica* n. gen., n. sp.; *Rupisalda slateri* n. sp., *Rupisalda vincenti* n. sp., and *Rupisalda atra* n. sp. (Saldidae). Additional descriptive notes are given for *Leptopoides horvathi* (Drake and Hottes) and *Saldula madagascariensis* Cobben. Other described taxa occurring in the region are discussed.

Our knowledge of the Leptopodomorpha of Madagascar, the Comores and the Mascarene Islands is poor, as noted by Paulian in his summary of the fauna of Madagascar and nearby islands (1961:223), consisting of isolated descriptions of a few species based on scanty material. Collections made in recent years, however, have revealed that Madagascar and the surrounding Indian Ocean islands have a rich shore bug fauna containing many endemic genera and species. In this revision we review previous works, provide keys to genera and species, and describe two new genera and two new species of Leptopodidae plus two new genera and four new species of Saldidae. Most of the material discussed below was collected jointly during an expedition to Mauritius and Madagascar supported in part by the National Geographic Society, and by the junior author during an expedition to Aldabra and Cosmoledo Atolls, supported by the Smithsonian Insitution's Aldabra Project and the Seychelles Islands Foundation.

All measurements are in millimeters. Institutional abbreviations and information on the deposition of type material is contained in the acknowledgments section.

FAMILY LEPTOPODIDAE

The last revision of the family Leptopodidae was provided by Horvath (1911). Germane to this project, he described the genus *Martiniola* and furnished a key to world genera. His key was flawed (e.g., erroneously states that the fore femur of *Valleriola* has only one row of spines) and did not contain all genus-group names now known so a new key is provided below that includes the new genus-group names described herein and the subgenus *Pseudopatapius* Drake and Hoberlandt 1951. The key is based on material in the Polhemus collection representing all known leptopodid genus-group taxa of the Old World. In Leptopodidae, the first visible rostral segment

is actually segment two, which should be borne in mind when comparing other keys to the one given here. The nomenclature follows the latest tribal level conspectus of Schuh, Galil and Polhemus (1987), wherein the tribe Leptopodini includes all of the taxa treated by Horvath (1911) as belonging to the family Leptopodidae.

All members of the Old World tribe Leptopodini have been shown to possess a stridulatory mechanism involving the first abdominal tergite and the vannus of the posterior wing, an apomorphy separating Leptopodini from Leotichiini (Pericart and Polhemus, 1990). The extensive discussion and figures of these structures, given for all of the Madagascar genera, is not repeated here.

KEY TO THE GENERA OF LEPTOPODINI

1a. First visible (second) segment of the rostrum armed on each side with two long and fine spines, second segment without spines or at most with setiform spines, not dilated 2

1b. First two visible segments of the rostrum armed with stout spines, the second segment dilated on its inner side 5

2a. Third antennal segment very much longer than second; entire length of anterior tibia with numerous very short spines (setiform or stout) in one densely packed regular row; head without dorsal spines, or at most with slender setiform spines 3

2b. Third antennal segment a little longer than second; spines of the anterior tibia less numerous and less densely packed, not more than about 10 in each of one or two rows; head with stout dorsal spines at least on clypeus and frons 4

3a. Third antennal segment more than 3 times as long as second; head across eyes clearly wider than pronotum; pronotal calli set with 4 (2+2) thick conical spines; fore tibia set with yellowish setiform spines ..... *Erianotoides* n. gen.

3b. Third antennal segment about 2 to 2.3 times as long as long as second; head across eyes at most approximately equal to width of pronotum (usually); pronotal calli not spinose, or at most set with slender setiform spines; fore tibia set with stout dark spines ..... *Valleriola* Distant

4a. Anterior tibia provided with only one row of rather short spines; the spines of the anterior femora directed almost perpendicularly beneath; pronotum and hemelytra set with long soft hairs ..... *Erianotus* Fieber

4b. Anterior tibia armed with two rows of long spines, these spines as well as those of the anterior femora are divergent, those of the anterior row being directed forward and those of the posterior row to the rear; pronotum and hemelytra bristling with setiform spines ..... *Martiniola* Horvath

5a. Second antennal segment longer and thinner than the first, the third two to three times as long as second; first cell or inside of the membrane subequal to or only a third or a fourth shorter than the second 7

5b. Second antennal segment shorter, almost as thick as the first, the third almost ten times as long as second; first cell of the membrane greatly shortened, three-fourths shorter than the second ..... *Patapius* Horvath 6

6a. Eyes subglobose, set with long stout spines ..... subgenus *Patapius* Horvath

6b. Eyes larger, globose, set with slender setiform spines ..... subgenus *Pseudopatapius* Drake & Hoberlandt

7a. Eyes with at most short insignificant setae; clypeus and vertex of head without spines; fore tibia set with slender dark spines beneath, plus two stout anteriorly directed spines basally; first (inner) cell of membrane extending posteriorly almost as far as second; fourth (outer) cell of membrane slightly shorter than third; venation of fore wing as in Figure 2 ..... *Leptopoides* n. gen.

7b. Eyes with short slender spines; clypeus and vertex of head set with spines; fore tibia set with two divergent rows of long stout spines directed anteriorly and posteriorly; first cell of membrane one-third to one-fourth shorter posteriorly than second; fourth cell of membrane about ⅔ as long as third; for venation of fore wing, see figure 21B, J. Polhemus 1985 (p. 41) ..... *Leptopus* Latreille

Erianotoides, new genus
Figs. 1, 6–10

Description. Small, elongate, length 3.33–3.53 mm; maximum width (across posterior portion of hemelytra) 0.97–1.00 mm. Ground color leucine to pale whitish tan, sparingly marked with brown; venter leucine. Head, anterior part of pronotum, venter with short to moderate length pale setae. Frons glabrous; pronotum except for callus, hemelytra except for membrane, alveolate. Pronotal calli raised, mammilose, each callus with 2 very stout tapered dorsally directed spines, each sheathed basally, translucent distally; posterior lobe with a ragged (sometimes double) row of 5 to 7 stout spines.

Head with a distinct "neck," narrowed behind eyes. Eyes extremely large, globose, exserted, far removed from pronotum, without spines or visible setae; ocelli small, set on a tall slender tubercle. Bucculae platelike, protruding anteriorly, angulate; postclypeus bulbous, protruding anteriorly. First visible (second) rostral segment with 4 (2+2) stout spines directed ventrally (dorsally in repose), first pair at basal ¼, the second pair just past middle; second visible (third) rostral segment with several short setae. Head ventrally with 6 (3+3) long stout ventrally directed spines arranged in two longitudinal rows, one beneath each eye. Anterior acetabula set with a stout anteriorly directed spine. Anterior legs stoutest; anterior femur stout, tapering, ventrally set with two closely set longitudinal rows of short stout spines along with several long slender spines, 2 in anterior row and 3 in posterior row; anterior tibia beneath with a closely set row of distally angled stiff spine-like setae. Middle and hind legs slender, unarmed, with short setae. All tarsi long, slender, three segmented. Antennal segment 1 short and stout, 2 much longer and slender, 3 and 4 filamentary and extremely long.

Pronotum long, narrowed ahead of humeri, strongly constricted on anterior ⅔, expanded laterally on posterior ⅓; collar flared but not set off; callus raised, set with spines, weakly sulcate medially. Posterior lobe tumid, spinose, humeri prominent; posterior margin almost straight, with a weak posteriorly produced median angle. Scutellum raised, tapering to a sharp point posteriorly; with 2 (1+1) basal knobs laterally, with 2 to 4 stout spines on distal part, not always symmetrically placed; medially with a large oval depression.

Hemelytra elongate, membrane with four cells, inner cell longest; venation as in figure 6; hypocostal lamina well developed, foveate, widest behind metepisternum, tapering posteriorly, reaching nearly to membrane; except for membrane, covered with scattered stout spines, always placed on prominent veins.

Nymph not known.

Discussion. Erianotoides appears close to *Erianotus,* as the name implies but, according to a recently completed cladistic analysis (JTP, unpublished), is more

closely related to *Valleriola.* Apomorphies for *Erianotoides* are as follows: pattern of fore tibial spines (unique); isolated row of spines on posterior pronotal lobe (unique); tall slender ocellar tubercle (shared with *Erianotus*).

The smallest species of *Valleriola* (*wilsonae* Drake and *tribulosa* J.& D. Polhemus, both from Australia), share some key characteristics with *Erianotoides,* e.g., head as wide as pronotum due to the relatively large eyes, latter with dorsal setiform spines. The very thick conical spines on the pronotum, the second row of stout spines on the posterior lobe of the pronotum, the scattered stout spines on the hemelytra, the light coloration and the extremely long antennae immediately separate *Erianotoides* from any known species of *Valleriola,* and any other genus of Leptopodidae. (We have examined 22 species of *Valleriola* in comparison, 8 of them undescribed; all are dark in coloration.) These characters also separate *Erianotoides* from *Erianotus* and *Martiniola,* but in addition the spiny armature of the fore tibia of these genera is different, as given in the key.

Type-species. Erianotoides oculatus, new species.

Etymology. The name *Erianotoides* (masculine) refers to the similarity to *Erianotus.*

Distribution. Madagascar, Tulear Prov.

Erianotoides oculatus, new species
Figs. 1, 6–10; map 1

Description. See generic description. Head width/length 0.90/0.57, tan, shining, frons flat, nearly vertical, tylus prominent; eye width/length 0.27/0.47; frons covered with numerous very short recumbent golden setae; vertex depressed, bearing irregular brown patches to either side of midline adjoining inner margins of eyes; head separated from remainder of head by broad transverse sulcus, this sulcus pale tan centrally, marked with dark brown laterally; antennal segments I–III pale tan, lacking apparent setae except for a few semi-erect pale setae near tip of III, segment IV brown, covered with long semi-erect pale setae, lengths of segments I–IV: 0.27, 0.70, 2.33, 1.20.

Pronotum width/length 0.77/0.73; anterior margins slightly flared to form narrow collar set off by a transverse row of punctations; posterior lobe separated from anterior lobe by broad transverse depression, with a transverse row of 4–5 short sharp black spines near posterior margin; general coloration of pronotum pale tan, with irregular brown glabrous areas surrounding bases of calli and adjoining lateral margins, lateral and posterolateral margins raised to form narrow glabrous lip. Scutellum tan with basal angles dark brown, width/length 0.30/0.33; central portion with a semicircular depression, lateral areas around this depression slightly raised and rounded, bearing 2 (1+1) short sharp spines medially; basal angles each with a small rounded protruding dark tubercle; posteriorly elongate and acute.

Hemelytra tan with irregular brown fasciae, these fasciae variable in size and intensity, occupying the following areas: basal ¼ of corium and onto basal ⅓ of clavus, central portion of corium adjoining distal ⅓ of clavus, posterior part of corium adjacent to membrane; membrane pallid, length of clavus along outside margin 1.23, along commissure 0.90.

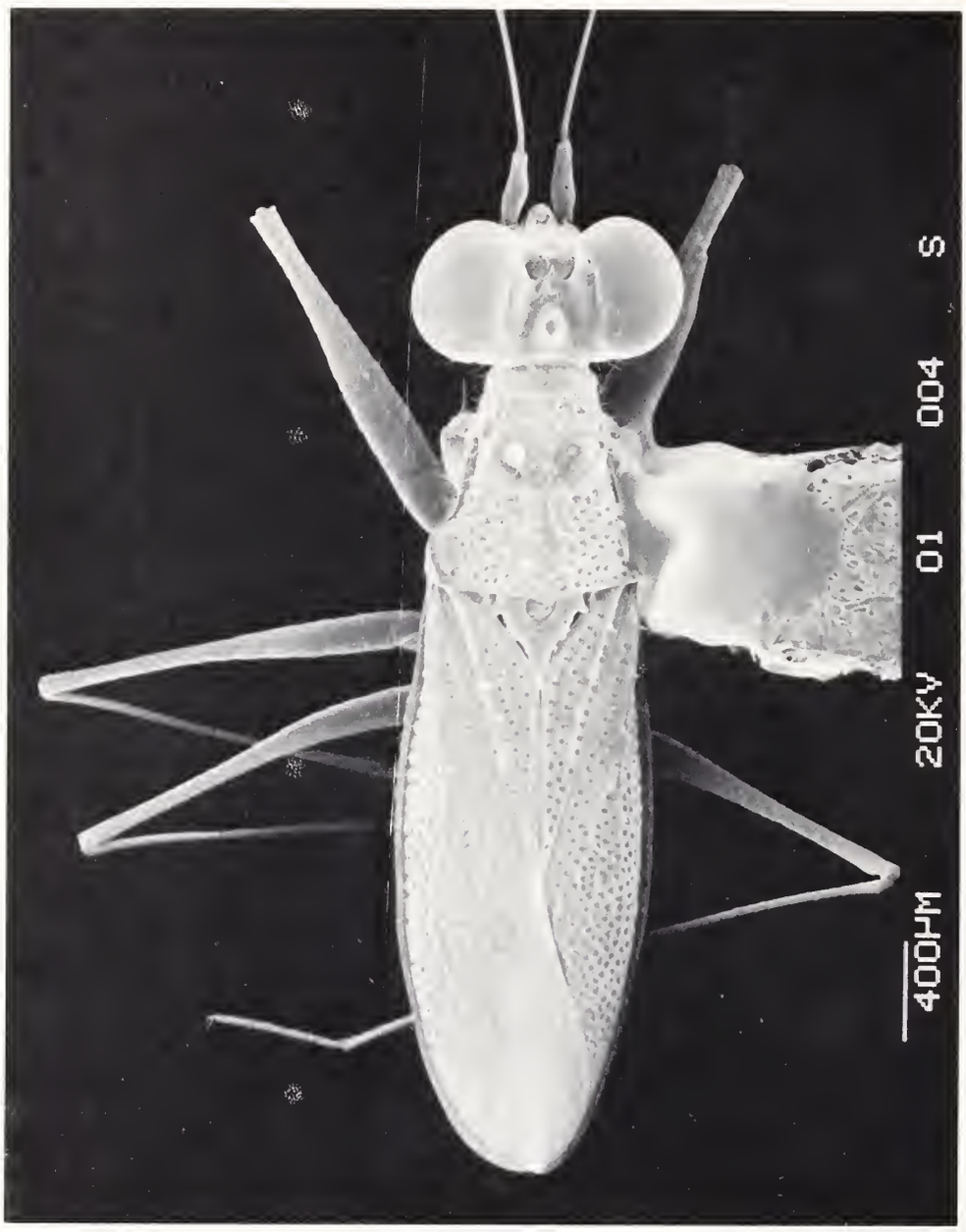


Fig. 1 *Erianotoides oculatus,* habitus.

Ventral surface of head, thorax, and abdomen tan, sparsely set with long slender semi-erect pallid setae; rostrum pallid, tip brown, sharply bent between first and second joint, length 0.80, attaining fore coxae in typical reflexed position. Legs elongate, slender, pallid, sparingly and irregularly marked with brown; fore- and middle femora with 4–6 raised brown patches on medial portion of posterior face; all leg

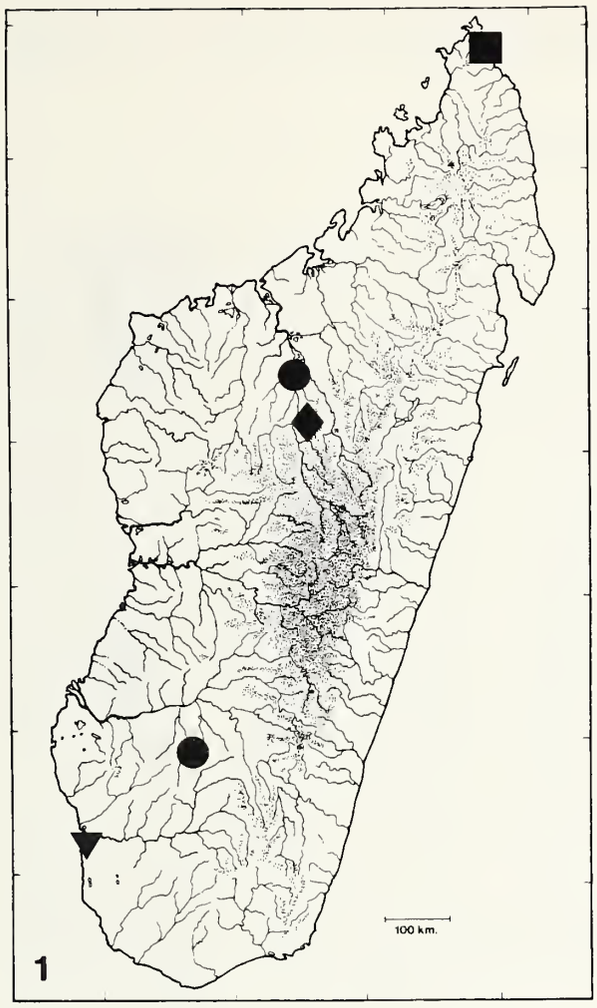
→

Map 1. Leptopodidae, distribution on Madagascar: *Erianotoides oculatus,* triangle; *Leptopoides horvathi,* square; *Martiniola madagascariensis,* circles; *Martiniola pulla,* diamond.

Map 2. Leptopodidae, distribution on Madagascar: *Valleriola strigipes.*

Map 3. Saldidae, distribution on Madagascar: *Rupisaldula slateri,* squares; *Rupisaldula vincenti,* circles; *Salduncula seychellensis,* diamond.

Map 4. Saldidae, distribution on Madagascar: *Saldula ornatula,* square; *Saldula niveolimbata,* diamond; *Saldula madagascariensis,* circles; *Capitonisaldoida cryptica,* triangle.


100 km.
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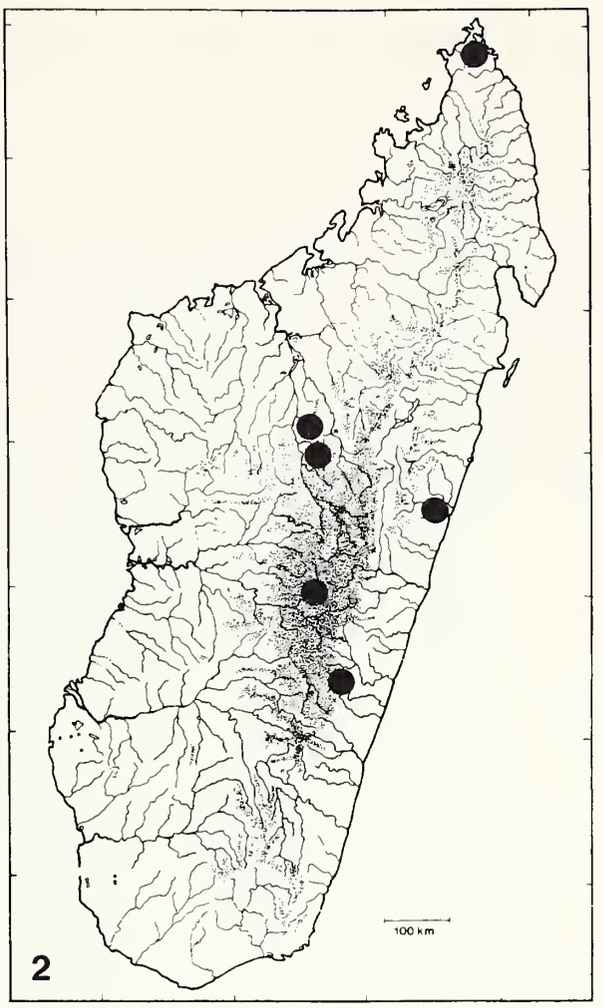
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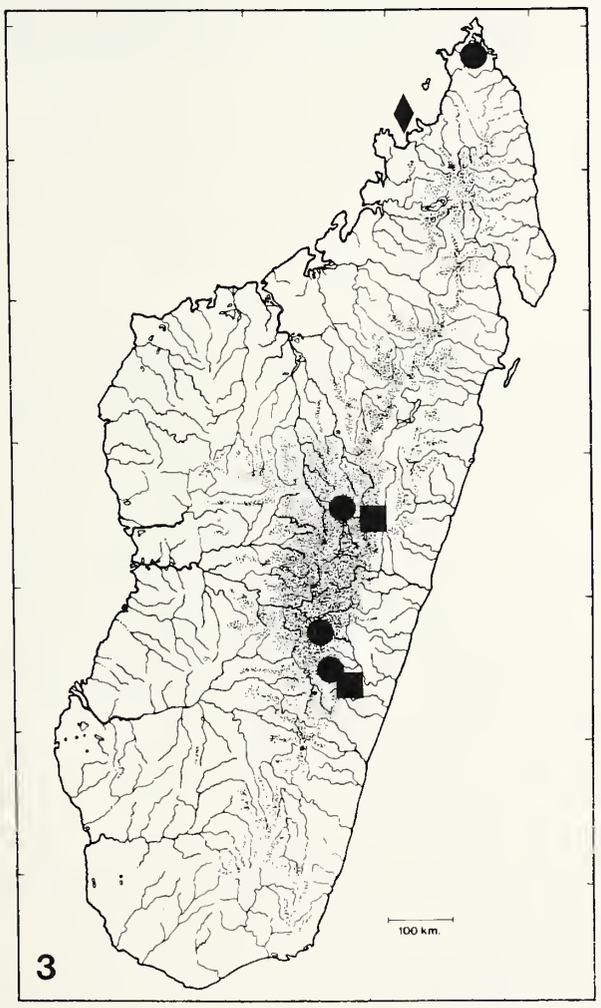
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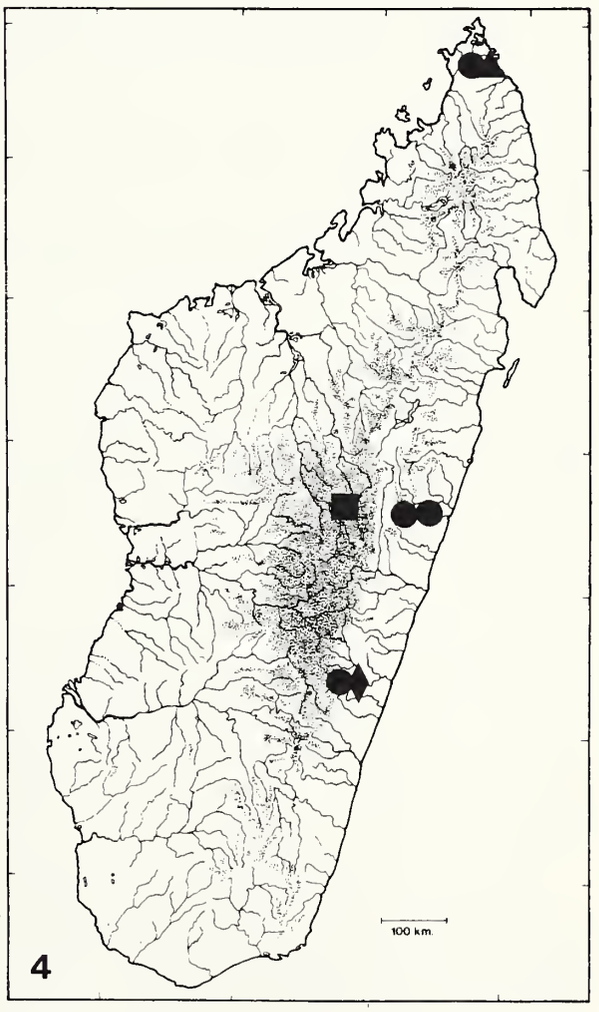
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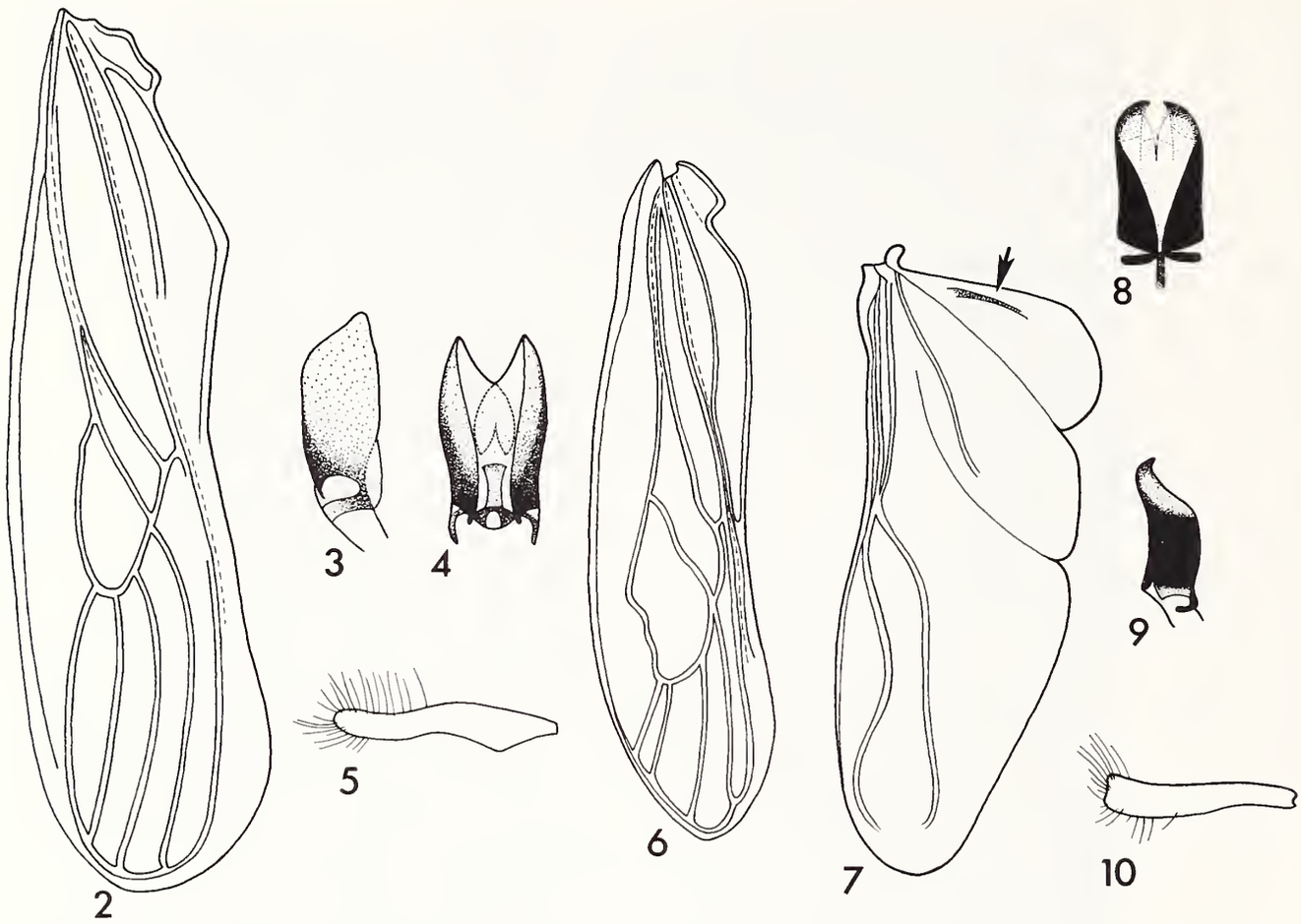


Figs. 2–10. Leptopodidae. 2–5. *Leptopoides horvathi.* 2. Hemelytra. 3–4. Male aedeagus, two views. 5. Male paramere. 6–10. *Erianotoides oculatus.* 6. Hemelytra. 7. Hind wing, showing vannus with stridulatory denticles (arrow). 8–9. Male aedeagus, two views. 10. male paramere.

segments covered with short recumbent golden setae; claws slender, gently curving, golden.

Male genitalia as in Figures 8–10.

Discussion. See under generic description.

Habitat data. Known so far only from Le Grotte, a limestone sink hole adjacent to the sea south of Tulear. This grotto contains a large pool fed by submerged fresh water springs, scattered with huge blocks of fallen limestone, some emergent. At high tide the pool is flooded by sea water and the surface level rises several feet. The humidity in this grotto remains fairly high and the air temperature quite moderate in spite of the dry searing heat in the spiny desert just above. The walls and ceiling of the grotto range from well lit to quite dark in the inner recesses. *E. oculatus* was collected from steep walls and the ceiling in the moderately well lit portions of the grotto, but not in direct sunlight; individuals ran rapidly over the surface and flew when disturbed. Because the bugs were the same color as the substrate they lived on they appeared ghost-like against the dimly lit rock.

Etymology. The name *oculatus* refers to the extremely large eyes in relation to the body.

Holotype. Macropterous male: MADAGASCAR, Tulear Prov.: Le Grotte, ~20km S of Tulear on St. Augustine Rd., sea level, CL 2293, XI-28-1986, J. T. & D. A. Polhemus (USNM).

Paratypes. 19 males, 14 females, same data as holotype (JTPC).

Leptopoides, new genus
Figs. 2–5

Description. Length 3.66 to 4.28 mm., width across hemelytra 1.03 to 1.26 mm. Ground color blackish brown, marked with testaceous to leucine; venter mostly dark in males except prosternum; in females abdominal venter leucine tinged with brown. Head thickly clothed with appressed pale pubescence; pronotum, hemelytra with pale scalelike setae; venter with short to moderate length pale setae. Dorsum faintly shining; pronotum except for calli, hemelytra except for membrane covered with closely set foveae, weaker on hemelytra. Dorsal surface without spines. Scutellum with 2 (1+1) basal knobs laterally. Eyes with scattered short slender setae.

Head with a distinct "neck," narrowed behind eyes. Eyes extremely large, globose, exserted, far removed from pronotum; ocelli small, set on a raised tubercle. Bucculae plate-like, protruding ventrally, angulate; postclypeus tumid, slightly protruding anteriorly. First visible (second) rostral segment with 4 (2+2) stout spines directed ventrally (dorsally in repose), first pair at basal ¼, the second pair just past middle; second visible (third) rostral segment with 4 (2+2) spines, first pair stout, second pair slender, and several stout setae. Head ventrally with 6 (3+3) long stout ventrally directed spines arranged in two longitudinal rows, one beneath each eye. Anterior acetabula set with a stout anteriorly directed spine; an adjacent spine arising from prosternum laterally behind collar. Forelegs stoutest; coxae medially set with a stout anteriorly directed spine, and distally with 2 distally directed spines; trochanter set with 6 ventrally directed spines; femur stout, tapering, ventrally set with two longitudinal rows of stout spines, 5 very long stout spines evenly spaced among 12–14 short spines in anterior row, and about 14 short spines in posterior row, along with 3 anteriorly directed long stout spines on anterior face; tibia beneath with a closely set row of distally angled stiff spines as long as width of tibia, and two long stout anteriorly directed spines on basal half. Middle and hind legs slender, unarmed, with short setae. All tarsi long, slender, three segmented. Antennal segment 1 short and stout, 2 much longer and slender, 3 and 4 filamentary and extremely long, distal segment set with recumbent setae.

Pronotum long, narrowed ahead of humeri; collar flared, set off by a row of pits; callus raised, weakly sulcate medially. Posterior lobe tumid, humeri prominent; posterior margin almost straight. Scutellum raised basally, depressed medially, roughly triangular; medially with a large rectangular depression set with 2 (1+1) tiny tubercles.

Hemelytra elongate, membrane with 4 cells, inner cell longest; venation as in Figure 2; lateral cell leathery, alveolate, similar to outer corium; hypocostal lamina well developed, foveate, widest behind metepisternum, tapering posteriorly, reaching nearly to membrane.

Nymph with complement of spines as in adult, but additionally with the following: spines on postclypeus, frons, vertex, eyes, pronotum, wing pads, all abdominal tergites and last two ventrites, middle acetabulae and coxae, middle and hind femora, a third long stout spine on anterior tibia, and 8 (4+4) spines on second visible rostral segment. With a single large median scent gland opening on posterior margin of third abdominal tergite.

Discussion. Leptopoides is very close to *Leptopus,* as the name implies, but may be separated from the latter by the relatively shorter second antennal segment (Ratio II/I, 1.79 to 2.00 in *Leptopoides,* 2.63 to 3.00 in *Leptopus*), the lack of spines on the

dorsum (However in *Leptopus travancorensis* Distant the dorsal spines are short to medium length, setiform, recumbent), the different forewing venation, and the arrangement of spines on the fore tibia; the latter is unique and an apormorphy.

Drake and Hottes (1951) mentioned the lack of dorsal spines and described the membrane cells, but in the unique type specimen the distal three antennal segments were missing. On the basis of the armature of the fore legs, spinose and flattened second rostral segment and venation of the hemelytra they placed *horvathi* in *Leptopus,* however in our view the venation of the hemelytra is an apomorphy (shared with *Valleriola*) and a key character separating the two genera. Compare the configuration of the membrane cells shown in Figure 2 with those of *Leptopus* shown in figure 21B, Polhemus 1985 (p. 47) where the lateral cell of the membrane is displaced distally.

This genus is the sister group of the *Leptopus* species occurring in India and nearby regions, a group typified by *Leptopus travancorensis* Distant. While the two genera may be separated by the characters given above, they are convergent in general appearance, leading Drake to misidentify a specimen of the latter species as *L. horvathi.* We have seen several closely related undescribed species of *Leptopus* from India.

Type-species. Leptopus horvathi Drake and Hottes 1951.

Etymology. The name *Leptopoides* (masculine) refers to the similarity to *Leptopus.*

Distribution. Madagascar, Comores.

Leptopoides horvathi (Drake and Hottes),
New Combination
Figs. 2–5; map 1

Leptopus horvathi Drake and Hottes, 1951. J. Kansas Entomol. Soc. 24:24. Type, male, Tealo, Madagascar, in Muséum National d'Histoire Naturelle, Paris.

Additional description. See generic description; only additional details given here. Coloration: Head with large quadrate spot behind ocelli, entire dorsum anterad of vertex and venter, leucine. Pronotum with narrow light stripe on lateral margins along most of length, posterior lobe with median longitudinal carina and two (1+1) large fascia removed from midline, yellowish. Hemelytra with embolium, all veins in or bordering clavus, basal angle of inner corium, medial and distal spots at outer edge of inner corium, 2 distal spots on outer corium, basal spot on membrane cell 1, leucine. Legs, basal part of antennae leucine to testaceous, antennae dark distally.

Female length 4.28, width 1.26. Head width 1.04; length 0.59; minimum interocular space 0.22; eye length 0.52, width 0.44. Length visible rostral segments I–III; 0.59, 0.33, 0.18. Length antennal segments I–IV: 0.22, 0.37, 1.15, 1.11. Pronotum length 0.81; width across humeri 1.00, across collar 0.48. Scutellum length (visible) 0.41; width 0.59. Hemelytra length 2.44; length claval commissure 0.67. Length of legs: anterior femur 1.37, tibia 1.04, tarsi (combined tarsal segments) 0.33; middle femur 1.44, tibia 1.55, tarsi 0.41; hind femur 1.55, tibia 2.18, tarsi 0.48.

Discussion. See key, generic description and discussion under *L. poissoni* below.

Habitat data. This species was found at only one locality near Diego Suarez, where it frequented medium sized rocks along a small partially shaded stream located in a small valley amid secondary dry deciduous forest. These insects ran rapidly over the

rock surfaces and flew with little provocation, necessitating quick work with an aspirator to capture them.

Material examined. MADAGASCAR, Diego Suarez Prov.: 36 males, 19 females, 7 nymphs, small forest stream 5 km N of Joffreyville, 488 m, CL 2281, Water temp. 20°C, XI-16-1986, J. T. & D. A. Polhemus (JTP).

Leptopoides poissoni, new species

Description. See generic description; only additional details given here. Coloration: Head with large quadrate spot behind ocelli, entire dorsum anterad of vertex and venter, leucine. Pronotum with short narrow light stripe on lateral margins ahead of humeri, median longitudinal carina on posterior lobe, yellowish. Hemelytra with embolium, all veins in or bordering clavus, medial spot at outer edge of inner corium, basal spots on membrane cells 1 and 2, leucine. Legs, antennae leucine to testaceous. Female length 4.28, width 1.26. Head width 1.11; length 0.67; minimum interocular space 0.22; eye length 0.52, width 0.44. Length visible rostral segments I–III: 0.48, 0.30, 0.18. Length antennal segments I–IV: 0.26, 0.52, 1.30, 1.52. Pronotum length 0.93: width across humeri 1.15, across collar 0.48. Scutellum length (visible) 0.41; width 0.56. Hemelytra length 2.81; length claval commissure 0.67. Length of legs; anterior femur 1.37; tibia 1.07, tarsi (combined tarsal segments) 0.37; middle femur 1.52, tibia 1.59, tarsi 0.44; hind femur 1.59, tibia 2.37, tarsi 0.41.

Discussion. The unique female is very similar to *L. horvathi* in general appearance, but differs in having the third antennal segment relatively shorter than the fourth (III:IV; 1.30:1.52 vs. 1.15:1.11 in *horvathi*) and much shorter spines on the anterior femora (longest spine length:max. width of anterior femur; 0.18:0.18 vs. 0.36:0.18 in *horvathi*).

Habitat data. Not known.

Etymology. Named for Raymond Poisson to recognize his contributions to the study of the aquatic Heteroptera of Madagascar and the African region.

Holotype. Macropterous female, COMORES ISL., Moheli: Environs Cascade Kangani, VI-1954, J. M. (CJD, Poisson Coll.).

KEY TO THE SPECIES OF *MARTINIOLA*

1a. Ground color brownish black, sparsely marked with testaceous or leucine. Ratio of antennal segments II–IV: 1.19, 1.44, 0.83 ..... *pulla* Drake

1b. Ground color yellowish brown to dark brown, more extensively marked with testaceous or leucine. Ration of antennal segments II–IV: 1.19, 1.22, 0.65 .... *madagascariensis* (Martin)

Martiniola madagascariensis (Martin)
Map 1

Erianotus madagascariensis Martin, 1897. Bull. Soc. Entomol. Fr. 1897:274. Types, 2 specimens (sex not known), Madagascar, in Muséum National d'Histoire Naturelle, Paris.

Martiniola madagascariensis Horvath, 1911. Ann. Mus. Nat. Hung. 9:366, fig. 3.

Discussion. We did not collect this species, but we have studied material in the

Drake Collection (CJD) and the Polhemus Collection (JTPC). The coloration of this species is quite variable in a given series, and the structural characteristics are almost identical to *M. pulla* Drake. Only the antennal ratios separate the two species, and as only one specimen of each was available with the antennae entire, and these were of opposite sexes, this character may prove to be sexually dimorphic or variable. When a series of *pulla* including males becomes available we suspect that it may prove to be only a dark color form of *madagascariensis.*

Material examined. MADAGASCAR, Tulear Prov.: 3 males, 1 female, Isalo, Coll. R. P. [Paulian?], VIII-41 (CJD, JTPC): Majunga Prov.: 1 male, 1 female, Maevatenana, VIII-41, collector's name illegible (CJD).

Martiniola pulla Drake
Map 1

Martiniola pulla Drake, 1955. Proc. Biol. Soc. Wash. 68:110. Type, female, Tamatave, Madagascar, in C. J. Drake Collection, USNM.

Discussion. See under *M. madagascariensis* (Martin). Our single specimen was collected along with *Valleriola strigipes* on natural stone walls and large boulders along the Mamokomita River.

Material examined. MADAGASCAR, Majunga Prov.: 1 female, Mamokomita River and tributaries, 19 km SE of Andriba, 655 m, CL 2270, XI-8-1986, J. T. & D. A. Polhemus (JTP).

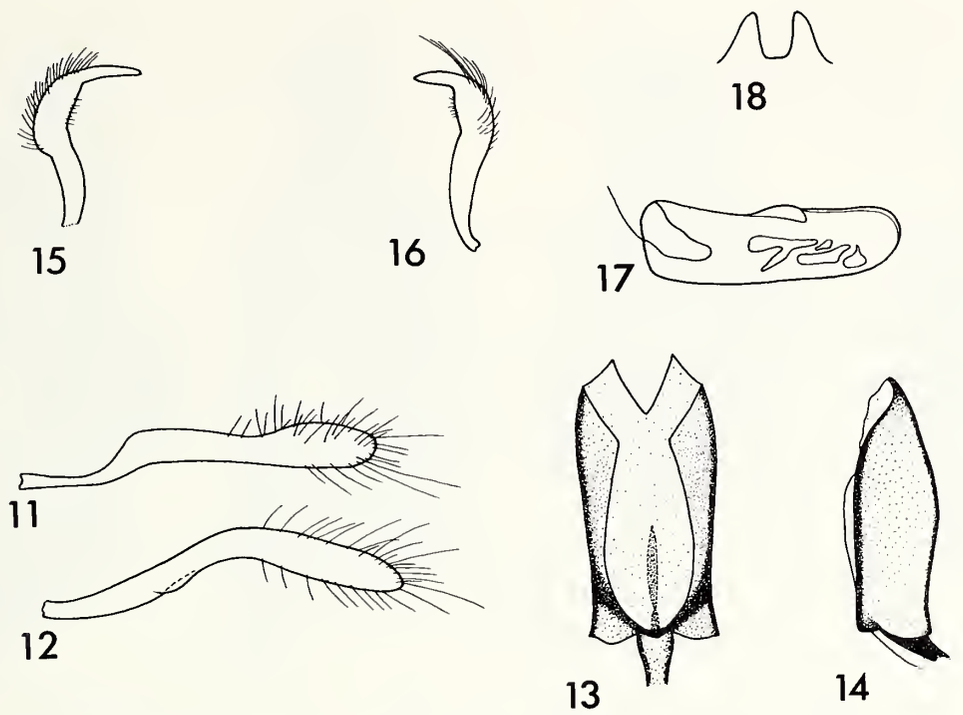
Valleriola strigipes (Bergroth)
Figs. 11–14; map 2

Leptopus strigipes Bergroth, 1892. Ann. Entomol. Soc. Fr. 60 (Bull.): CLI. Types, 2 specimens, sex unknown, Madagascar, in Muséum National d'Histoire Naturelle, Paris.
Valleriola strigipes Horvath, 1911. Ann. Mus. Nat. Hung.: 364.

Discussion. This is a common widespread species in Madagascar, and is easily separated from its African congeners by the hairy dorsal vestiture and distinctive light markings. These insects generally favor steeply sloping rock or cement walls just above the water surface of streams or ponds, although some specimens were taken quite removed from the water. Due to its preference for such open vertical substrates shielded from direct sunlight this species is often found on bridge abutments.

Bergroth (1892) described this species as a *Leptopus* species, and in 1906 again placed it in *Leptopus* and maintained that *Valleriola* was a synonym of the latter. Horvath (1911) showed that *Valleriola* was a distinct genus and placed *strigipes* in it.

Material examined (all collected by J. T. & D. A. Polhemus, all in JTPC). MADAGASCAR, Diego Suarez Prov.: 3 males, 3 females, rocky river and waterfall, 43 km S of Diego Suarez, 91 m, CL 2275, XI-12-1986. Majunga Prov.: 1 male, 1 female, Mamokamita River and tributaries, 19 km SE of Andriba, 655 m, CL 2270, XI-8-1986. Fianarantsoa Prov.: 2 females, 1 nymph, Tamara Creek at Ambatolahy, 4.5



Figs. 11–18. Leptopodidae, Saldidae. 11–14. *Valleriola strigipes.* 11–12. Male paramere, two views. 13–14. Male aedeagus, two views. 15. *Salduncula seychellensis,* male paramere. 16–18. *Saldula madagascariensis.* 16. Male paramere. 17. Aedeagus. 18. Parandria.

km W of Ranomafana, 885 m, CL 2251, X-31-1986. Tamatave Prov.: 4 males, 9 females, stream W of Antsampanana, 32 km S of Brickaville, 46 m, CL 2259, XI-4-1986. Tananarive Prov.: 5 males, 4 females, waterfalls and rapids, 61 km N of Ambositra, 1,387 m, CL 2242, X-29-1986; 1 male, Manakazo River at Manakazo Forest Station, 1,417 m, CL 2267, XI-7-1986.

FAMILY OMANIIDAE

The family Omaniidae is represented on the islands of the western Indian Ocean region by two species. One of these, *Corallocoris aldabrae* (Cobben, 1987b), was recently described from Aldabra and is discussed below. The other, *Omania coleoptrata,* is known from the coasts of the Red Sea, Oman, and Pakistan, all outside of the region treated here.

Corallocoris aldabrae Cobben

Corallocoris aldabrae Cobben, 1987. Revue Zool. Afr. 101:24. Type, female, Aldabra, Middle Island near East Channel, in British Museum (Natural History), London.

Discussion. This species was described from a single mutilated female, said to differ from *Corallocoris marksae* (Woodward) by the larger frontal light spots on the frons, lighter first acetabulae, and clearly notched hypocostal lamina of the forewing.

On Aldabra Atoll this species has been taken only along the margins of Passe Houareau, the easternmost of the channels connecting the lagoon to the open ocean. The insects were found here under and amid rounded coral cobbles lying on a bed of firm sand at the high tide line. For a further discussion of the habitat and behavior of *C. aldabrae* at Aldabra see D. Polhemus (1990).

Material examined. ALDABRA ATOLL, Malabar Is.: 27 adults, 8 immatures, shore of limestone and coral cobbles just north of Middle Camp, western side of Passe Houareau, low tide, 1300 hr, 22 March 1989, CL 8036, D. A. Polhemus (USNM, JTPC).

FAMILY SALDIDAE

Paulian (1961) noted that 3 species of shore bugs were known from Madagascar, but did not list them. Cobben (1987a) briefly reviewed the Saldidae of Madagascar and added one new species. He also noted another undescribed species that he did not name due to the poor condition of the specimen; it is a large species (6.5 mm) and does not seem to be any of those that we have studied.

KEY TO THE GENERA OF SALDIDAE OF MADAGASCAR, THE COMORES AND MASCARENES

(For terminology see J. Polhemus 1985)

1a. Transverse swelling of frons absent; pronotum short, length of head equal to or greater than 1.5 times the length of pronotum on midline ..... *Salduncula* Brown

1b. Transverse swelling of frons present; pronotum long, length of head less than 1.5 times the length of pronotum on midline 2

2a. Hypocostal ridge produced ventrally into a laminar structure; anterior pair of facial trichobothria reduced or absent ..... *Mascarenisalda* n. gen.

2b. Hypocostal ridge simple or with secondary ridge, but not produced ventrally into a laminar structure; anterior pair of facial trichobothria present 3

3a. Secondary hypocostal ridge present ..... *Saldula* Van Duzee

3b. Secondary hypocostal ridge absent 4

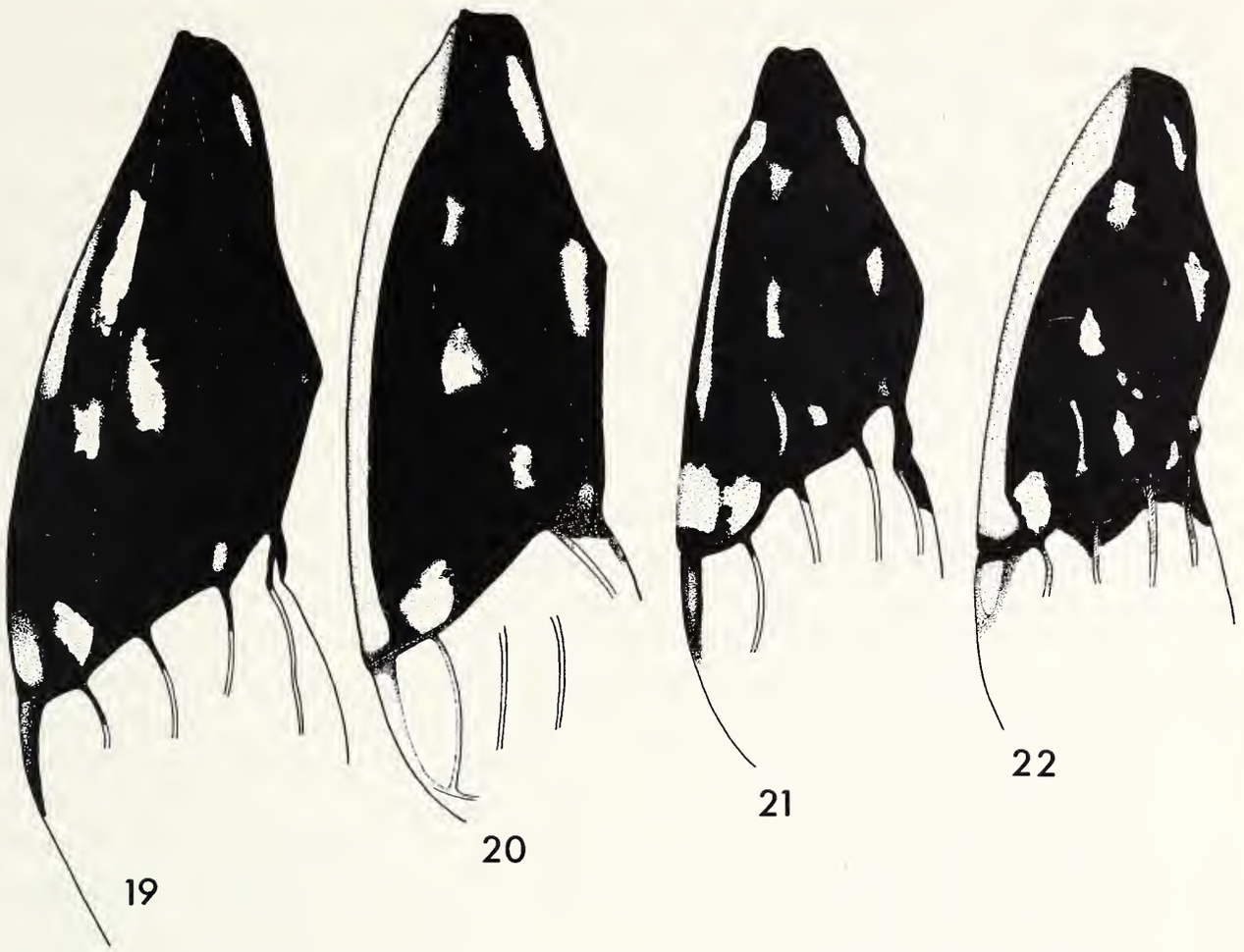
4a. Ratio eye width/minimum interocular space, 0.86; hind tarsal segment 2 ventrally set with 6 stout spines in posterior row, distal spine only slightly longer than others; tarsal segment 3 ventrally set with 6–7 stout spines in the posterior row plus several moderate length setae distally but without a very long setae arising at distal ¾. Ocelli separated by more than the width of an ocellus ..... *Capitonisaldoida* n. gen.

4b. Ratio eye width/minimum interocular space, 1.05 to 1.25; hind tarsal segment 2 ventrally set with 3–5 stout spines in the posterior row, distal spine about 2× longer than any other; tarsal segment 3 ventrally set with 1–2 stout spines in posterior row plus a single setae much longer than the spines arising at distal ¾. Ocelli approximate, separated by about ½ the width of an ocellus ..... *Rupisalda* Polhemus

Capitonisaldoida, new genus

Figs. 19, 23–27, 42–43, 46–47

Description. Of moderate size, ovate, length 4.6 to 5.6 mm, width across hemelytra 1.9 to 2.3 mm; sexes dimorphic in size, males noticeably smaller. Ground color shining blackish brown, marked with testaceous to leucine; venter mostly dark in males; in females abdominal venter brown tinged with leucine; pronotal margins yellowish at least on posterior half; light markings on clavus and corium evident. Head with frons faintly rugulose, vertex smooth; broad, width 73 to 77% of greatest pronotal width. Head, pronotum, hemelytra clothed with fine dark medium length



Figs. 19–22. Saldidae, hemelytra. 19. *Capitonisaldoida cryptica.* 20. *Rupisalda atra,* n. sp. 21. *R. slateri.* 22. *R. vincenti.* (hairy vestiture not shown).

setae and very fine golden recumbent pubescence; venter with short to moderate length pale setae; legs with scattered short slender setae and usual spines. Antennae long, slender, with short recumbent pubescence and scattered longer setae, some longer than the segment where they arise.

Eyes not appressed to thorax, large, globose, exserted, distinctly removed from pronotum; ocelli small, not raised, separated by the width of an ocellus; postclypeus not tumid, not sulcate longitudinally; transverse swelling weakly developed.

Pronotum short, about ¾ as long as head on midline, anteriorly narrowed, margins weakly concave; collar narrow, set of by a weak row of pats; callus raised, median pit well developed, set off from broadly convex posterior lobe by a weak curving row of pits (largely hidden by pubescence) not reaching lateral pronotal margins. Scutellum wider than long; medially with a weak transverse sulcus. Posterior tibial comb absent; hind tarsal segment 2 ventrally set with 6 stout spines in posterior row, distal spine only slightly longer than others; tarsal segment 3 ventrally set with 6–7 stout spines in the posterior row plus several moderate length setae distally but without a very long setae arising at distal ¾. No stridulatory mechanism evident.

Hemelytra elongate, lateral margins almost straight basally, evenly convex distally, macropterous; embolar fracture present, typical of Saldinae; embolar modification of female not evident dorsally; venation of corium weakly indicated; membrane long, well developed, with four cells, inner cell much shorter than adjacent cell; hemelytra

as in Figure 19: hypocostal ridge simple, well developed but not strongly produced ventrally, more pronounced posteriorly in females; secondary hypocostal ridge absent; female costal margin slightly reflexed medially; hind wings well developed, reaching beyond apex of abdomen.

Eversible abdominal gland present. Female with 7 ovarioles; second gonapophysis truncate apically, not sharp (Fig. 27); connecting piece of styloids attached basally; ring gland of gynatrium plainly sclerotized; spermatheca with single distal pump flange. Male filum gonopori coiled one and two-thirds times; processus sensualis of paramere very weakly developed, indistinct (see Fig. 23).

Nymph. Larval organ present but small, not protuberant, located slightly mesad of spiracle on ventrite III; abdominal scent glands well developed, without lateral channels.

Discussion. Capitonisaldoida new genus appears very close to *Capitonisalda* Polhemus 1981, as the name implies. It lacks a secondary hypocostal ridge, however, and the ocelli are separated by more than the width of an ocellus (vs. at most the width of an ocellus in *Capitonisalda*). The preocellar spot in *Capitonisalda* is wedge-shaped and transverse, the narrow end of the wedge approaching or touching the ocelli, whereas in *Capitonisaldoida* the preocellar spot is elongate, usually forming a crescent with the anterior part paralleling or touching the eye and the posterior part curving medially toward but never touching the ocelli. In *Capitonisalda* the pronotal callus is not prominently raised and/or distinct from the posterior lobe, the frons of the head is smooth or at most has rather anteriorly situated weak tumescences on each side, whereas in *Capitonisaldoida* the pronotal callus is prominently raised and distinct, and the frons is smooth except for a distinct indentation medially set with a short broad longitudinal sulcus. The male genital structures also differ in these two taxa; the endosomal sheath of *Capitonisalda* has a narrow stem expanded and deeply cleft basally and lobed in the usual saldid manner (Figs. 44, 48), and the basal apicolateral endosomal sclerite is bifurcate basally, forming two stout lateral arms (the upper short in one undescribed species; see Figs. 44, 49), whereas in *Capitonisaldoida* the endosomal sheath has a broader parallel-sided stem, not expanded, only weakly cleft basally and not lobed (Figs. 42, 46), and the basal apicolateral endosomal sclerite not bifurcate basally, as shown in Figures 26, 42 and 47. These two apomorphies as well as the other key characters discussed above separate *Capitonisaldoida* from its congeners.

(Note: after the body of this paper was completed, several additional differences between *Capitonisaldoida* and Capitonisalda were called to our attention by Dr. Per Lindskog during his visit to our laboratory. These include features of the endosomal sheath, sclerites of the male genitalia, and the shape of the preocellar spots. He has generously shared some of his observations on the delineation of saldid genera and provided comparative photos and figures for inclusion here.)

Capitonisaldoida belongs to a circumtropical assemblage of saldid species from the New World, Australia, Africa, and Madagascar that live in the same microhabitat: dark recesses in very wet places such as vertical rock faces with gently sheeting water or waterfalls splash zones. All of these species have a broad interocular space and a similar general facies, but this is apparently convergence, since almost every zoogeographical region apparently has its own genera, not all in the same clade.

Type-species. Capitonisaldoida cryptica new species.

Etymology. The name *Capitonisaldoida* (feminine) refers to the similarity to *Capitonisalda.*

Distribution. Madagascar (Mt. D'Ambre).

Capitonisaldoida cryptica, new species
Figs. 19, 23–27, 42–43, 46–47; map 4

Description. Head width/length 1.37/0.73, black, with transverse dark yellow stripe running across frons above base of tylus, tylus brown; eye width/length 0.37/0.60; frons and vertex covered with numerous very short recumbent golden setae sparsely intermixed with a few longer erect golden setae on vertex; antennae slender, brown, lengths of segments I–IV: 0.43, 1.17, 0.73, 0.70.

Pronotum shining black, width/length (midline) 1.90/0.67; lateral margins weakly concave, narrowly bordered with dark yellow; posterior margin of posterior lobe broadly concave medially; surface of entire pronotum covered with very short recumbent golden setae. Scutellum black, shining, width/length 1.37/1.33; anterior lobe only weakly raised, bearing shallow semicircular depression medially along posterior margin; posterior lobe weakly convex; surface of both lobes covered with very short recumbent golden setae.

Hemelytra black, portion inside of radial vein dull, portion outside of radial vein shining; clavus length along outside margin 2.17, length of commisure 0.83, each side bearing a small elongate dark yellow spot basally along inner margin; corium with each side bearing 2 elongate dull white spots, one to inside of radial vein near middle of vein, another on anterior ⅓ of embolium outside of and adjoining radial vein, and 2 small roughly circular dull white spots, one along medial portion of posterior margin adjoining membrane, another at base of embolar fracture; embolar margin narrowly bordered with dark yellow, black on basal ⅙ and at extreme posterior end; wing membrane fumate, lateral margin with narrowly triangular thickened dark yellow area extending from base to near apex, veins darker; surface of clavus, corium emoblium and thickened membranal area bearing numerous short recumbent semi-erect golden setae.

Ventral surface of head, thorax, abdomen and hypocostal ridge black, posterior margins of abdominal ventrites often narrowly bordered with creamy white; female subgenital plate broadly white; rostrum brown, length 2.10, attaining bases of hind coxae; entire ventral surface covered with short fine recumbent golden setae. Legs predominantly yellowish brown, darker on dorsal surfaces; all leg segments covered with short recumbent golden setae sparsely intermixed with longer fine upright golden setae; scattered erect black spines present on fore, middle and hind tibiae; claws slender, gently curving, golden.

Male genitalia as in Figures 23–26.

Discussion. See under generic description above.

Habitat data. This species was found only in the spray and splash zone under the high main waterfall at Grande Cascade. Individuals occurred in dark recesses and pockets, usually on vertical or overhanging basalt faces protected from direct spray or wetting but still in a very moist environment.

Etymology. The name *cryptica* refers to the very secluded microhabitat in which this species lives.

Holotype. Macropterous male, MADAGASCAR, Diego Suarez Prov.: Mt. D'Ambre, Grande Cascade, 671 m, CL 2278, XI-13-1986, J. T. & D. A. Polhemus (USNM).
Paratypes. 17 males, 12 females, 12 nymphs, same data as holotype (JTPC,TSIM).

Mascarenisalda, new genus
Figs. 28–31

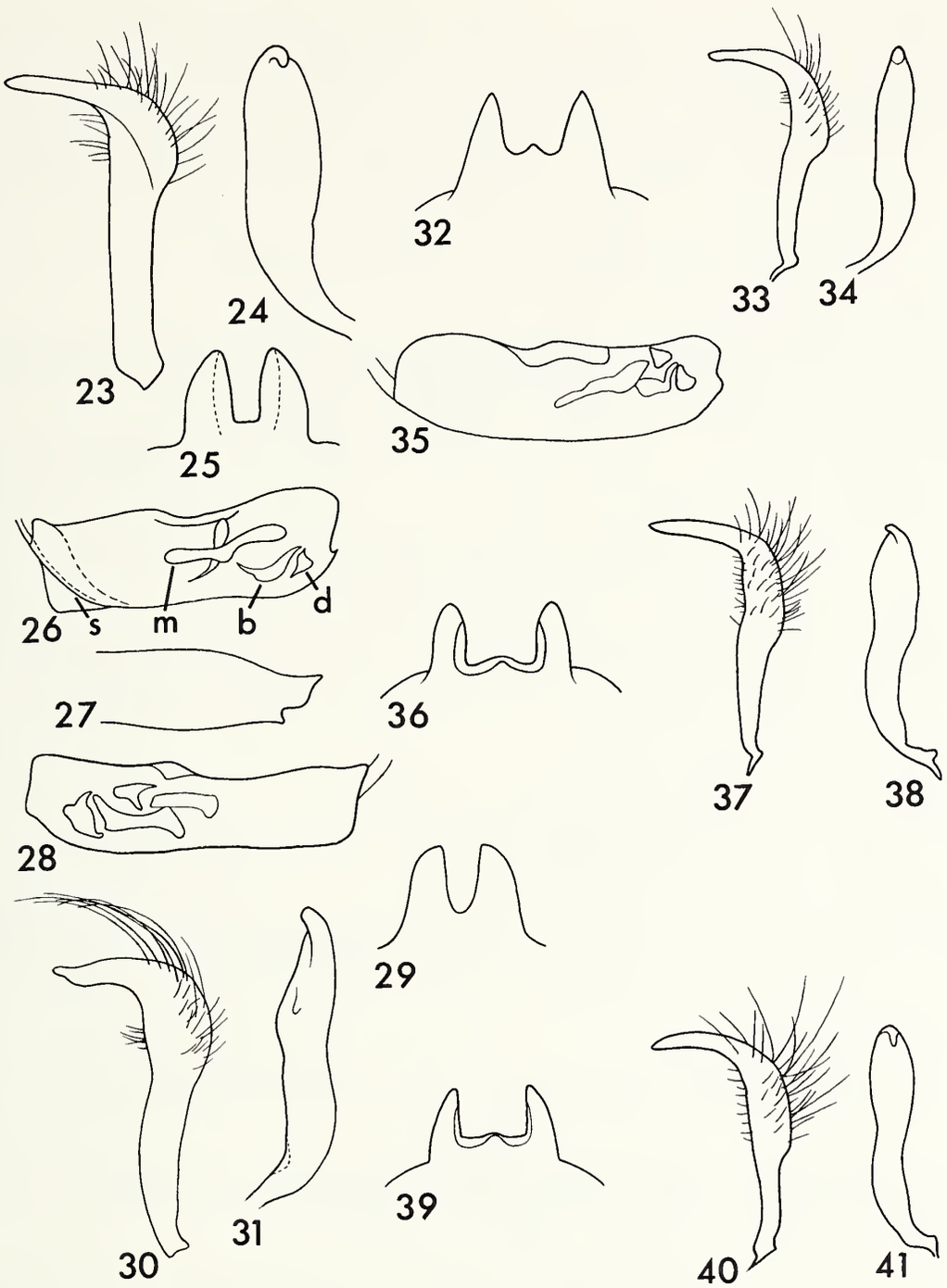
Description. Length 2.7 to 3.9 mm., width across hemelytra 1.4 to 1.8 mm. Ground color variable blackish brown to yellowish brown, extensively marked with testaceous, luteous, leucine, and white; venter usually luteous, abdomen medially mostly dark in males, lighter in females; pronotum with margins yellowish along most of length, variably marked with luteous, sometimes entirely luteous tinged with brown; light markings on clavus and corium extensive. Head with frons raised, sculptured, vertex smooth, broad, width 60% (macropterous female) to 86% (brachypterous male) of greatest pronotal width. Head, pronotum, scutellum clothed with coarse golden recumbent pubescence; hemelytra covered with dark medium length setae; venter with short recumbent pale setae; legs with scattered short slender setae and usual spines. Antennae long, slender, with short recumbent pubescence and scattered longer setae on distal 2 segments, not longer than the width of the segment of origin.

Head free from thorax, eyes large, globose, exserted, distinctly removed from pronotum; ocelli large, slightly raised, separated by less than the width of an ocellus; postclypeus tumid, sulcate longitudinally, flanked by 2 (1+1) additional tumescent ridges diverging anteriorly; transverse swelling strongly developed; with only the posterior two pairs of stiff black trichobothria evident instead of the usual three pairs.

Pronotum short, about as long as head on midline, strongly narrowed anteriorly, margins almost straight; collar wide, set off by a prominent row of pits; callus raised, median pit well developed, with broad median longitudinal sulcus, set off from posterior lobe by a prominent row of pits not reaching lateral pronotal margins. Scutellum about as wide as long; medially with a weak transverse sulcus. Posterior tibial comb present. No stridulatory mechanism evident at 80×, however it is possible that an SEM study will reveal extremely fine serrations on the sclerotized ventral margin of the hypocostal lamina.

Hemelytra truncate (brachypters) to elongate (macropters), lateral margins rather evenly convex in males, females with lateral (costal) margin slightly sinuate; brachypterous, submacropterous or macropterous; costal fracture present, typical of Saldinae; embolar modification of female evident dorsally as a short reflexed section; venation of corium weakly indicated; membrane variable, abbreviated to long with four cells, inner cell shorter than adjacent cell; hypocostal ridge consisting of a well developed lamina, strongly produced ventrally, with a sclerotized ventral margin, the entire lamina forming a shallow sulcus closed posteriorly at distal 5/6 (toward embolar fracture); secondary hypocostal ridge absent; female costal margin slightly reflexed at distal ⅔; hind wings reduced to well developed.

Eversible abdominal gland present. Female first gonapophysis with 10 stout teeth, weaker basally; second gonapophysis truncate apically, notched, not sharp; connecting piece of styloids free, not attached basally; ring gland of gynatrium weakly sclerotized; spermatheca with single distal pump flange; egg similar in shape to figure 1C in Cobben (1968:9). Male filum gonopori coiled two and one-half times; processus



Figs. 23–41. Saldidae, genitalic structures. 23–27. *Capitonisaldoida cryptica.* 23–24. Male paramere, two views. 25. Parandria. 26. Aedeagus: b, basal apicolateral sclerite; d, distal apicolateral sclerite; s, endosomal sheath; m, median endosomal sclerite. 27. Female second gonapophysis. 28–31. *Mascarenisalda mametiana.* 28. Aedeagus. 29. Parandria. 30–31. Male paramere, two views. 32–35. *Rupisalda atra.* 32. Parandria. 33–34. Male paramere, two views. 35. Aedeagus. 36–38. *R. slateri.* 36. Parandria. 37–38. Male paramere, two views. 39–41. *R. vincenti.* 39. Parandria. 40–41. Male paramere, two views.

sensualis of paramere very well developed, forming a sclerotized ridge (see Figs. 30–31).

Nymph. Head with 4 pairs of stiff cephalic setae. Wing pads almost entirely rugulose, covered with scale-like pads. Abdominal scent gland with two distinct slit-like openings, without lateral channels. Larval organ very large, raised, located almost at lateral edge of abdominal sternite 3.

Discussion. In Polhemus' cladistic analysis of the saldid genera of the world, this is 'genus C' (see J. Polhemus 1985:104). The apparent loss, or at least extreme reduction, of the anterior pair of cephalic trichobothria is a unique occurrence in the Leptopodomorpha as far as we know, and is an apomorphy. The laminar hypocostal ridge sets this genus apart from others occurring in the Indian Ocean region, but is convergent with several other genera from other parts of the world (e.g., St. Helena, the Palearctic region, and Hawaii). *Mascarenisalda* belongs to the same clade as an undescribed genus from Hawaii (placed in *Saldula* by Cobben, but far removed from the latter cladistically), but is separated from the Hawaiian genus by the extremely long setae arising from the corpus paramerus (see J. Polhemus 1985:100, apomorphic character 86), and the reduced anterior cepahalic trichobothria.

In one specimen there is a whitish waxlike substance in the channel-like lateral depression formed by the hypocostal lamina and costal margin, and also on the lateral part of the secondary scent fluid channel (formed by the episternal flap and metepisternum; for explanation, figures and terminology, see J. Polhemus 1985:29, figs. 16B–D). This coupled with the tight fit of the basal hypocostal region of the hemelytra and metepisternum suggests that the remarkably well developed hypocostal lamina functions as an extensive evaporatory surface for the fluids produced by the scent gland. The episternal flap in this species also has folds, which would increase surface area and tend to hold fluid.

Type-species. Saldula mametiana Drake 1953.

Etymology. The name refers to the restricted occurrence of this genus on the Mascarene island of Mauritius; feminine.

Distribution. As far as is known, this monotypic genus is restricted to Mauritius, although we have not collected on the nearby islands of Rodriguez and Reunion.

Mascarenisalda mametiana (Drake), **New Combination**
Figs. 28–31

Saldula mametiana Drake, 1953. Le Naturalist Malgache 5:167. Type, macropterous male, Mauritius, in C. J. Drake Collection, USNM.

Discussion. On Mauritius we found *Saldula mametiana* in a diverse array of microhabitats, which is characteristic of island species that are without competition; a similar situation prevails with *Saldula tahitiensis* Cobben on Tahiti. Brachypterous, submacropterous and macropterous forms with a wide range of total body sizes were commonly found together on mud and sand stream banks, vertical rock surfaces around waterfalls, seeping rock faces, mossy places, and bare surfaces on midstream rocks.

This species is quite highly marked with white and fulvous bands and spots, more so than Drake's habitus figure would indicate (see Drake, 1953, fig. 1); it is reminiscent of *Saldula opacula* Zetterstedt but more colorful than the latter.

Material examined (all collected by J. T. & D. A. Polhemus, all JTPC). MAURITIUS, Black River Dist.: 30 males, 26 females, 6 nymphs, stream 2 km S of Chamarel, 198 m, CL 2232, X-22-1986. Flacq Dist.: 1 male, 2 females, stream in cane field nr. Deep River, 150 m, CL 2226, X-20-1986. Moka Dist.: 20 males, 9 females, 3 nymphs, rocky mountain stream, 1 km E of Belle Rive, 573 m, CL 2225, X-20-1986. Plaines

Wilhelms Dist.: 28 males, 9 females, 3 nymphs, rocky stream at Curepipe, 500 m, CL 2222, X-19-1986. Savanne Dist.: 3 males, 3 females, 1 nymph, rocky stream nr. Grand Bassin, 579 m, CL 2229, X-21-1986; 5 males, 7 females, 1 nymph, rocky stream at viewpoint nr. Cascade Cecile, 625 m, CL 2231, X-21-1986. Also 1 male paratype, MAURITIUS, IV-14-1951, Ray Mamet (JTPC).

KEY TO THE SPECIES OF *RUPISALDA* OF MADAGASCAR AND THE COMORES

1a. Lateral margins of pronotum concolorous with disc, without light markings .. *atra,* n. sp.
1b. Lateral margins of pronotum each with a prominent yellowish longitudinal stripe ... 2
2a. Dorsum with long erect setae ..... *vincenti,* n. sp.
2a. Dorsum without long erect setae ..... *slateri,* n. sp.

Rupisalda atra, new species
Figs. 20, 32–35

Description. Large for genus, shape ovate, length 4.70–5.00 mm; maximum width (across hemelytra) 2.20–2.60 mm; ground color shining black, sparingly marked with white and dark yellow.

Head black, rugulose, width/length 1.15/0.59, bearing 2 (1+1) small yellow spots on upper frons at bases of trichobothria, 2 (1+1) additional wedge-shaped yellow spots present along inner eye margins on either side of vertex; ocelli large, yellowish; eyes large, protrusive, brown, width/length 0.30/0.48; frons and vertex covered with fine semi-recumbent golden setae; antennae slender, light brown, covered with short recumbent golden setae, lengths of segments I–IV: 0.52, 0.96, 0.70, 0.74.

Pronotum black, width/length (midline) 1.56/0.56; lateral margins almost straight, very slightly sinuate, without light markings; narrow collar present, separated from remainder of anterior lobe by punctate sulcus; anterior lobe tumescent, set off by curving punctate suture from broadly convex posterior lobe; posterior margin of posterior lobe broadly concave; surface of entire pronotum covered with semirecumbent golden setae. Scutellum black, shining, width/length 1.00/0.93; anterior lobe raised, separated from posterior lobe by sinuate sulcus; posterior lobe not raised; surface of both lobes covered with semirecumbent golden setae somewhat longer than on pronotum.

Hemelytra black to blackish brown, faintly shining; clavus length along outside margin 1.70, length of commissure 0.59, each side bearing an elongate yellow spot basally along inner margin and another elongate yellowish spot next to commissure near apex, inner ⅔ of each side dull pruinose, set off from faintly shining outer ⅓ by longitudinal row of punctations; corium uniformly faintly shining; inner corium with 2 roughly ovate spots and sometimes 1 posterior elongate spot evenly spaced along radial vein, plus 1 or 2 distal ovate spots in a more medial parallel row. Outer corium with 1 large white spot at base of embolar fracture, embolium broadly leucine over entire length; wing membrane fumate, darker basally, lateral margin with narrowly triangular thickened pale area extending from base to near apex, veins darker, forming 4 distinct closed cells; surface of clavus, corium and embolium set with moderate length fine recumbent golden setae.

Ventral surface of head and thorax black, abdomen brown and hypocostal ridge

leucine; rostrum brown, length 1.53, attaining hind coxae; entire ventral surface covered with short fine recumbent golden setae. Legs predominantly yellowish white with following portions marked with brown: all coxae basally, all of fore femur except scattered light markings basally and distally, distal ⅓ of middle and hind femora, all tibiae infuscated, and tarsi dorsally on all legs; all leg segments covered with fine semierect golden setae, plus scattered erect black spines on fore, middle and hind tibiae; claws slender, gently curving, brown.

Male genitalia as in Figures 32–35.

Macropterous female. Similar to male except larger and ventral abdominal sterna broadly marked with leucine to yellowish medially, less so laterally. Total length 5.0; width (across hemelytra), 2.6.

Discussion. Rupisalda atra is the first saldid reported from the Comores. It is a typical member of the circumtropical genus *Rupisalda* which has several members on the African mainland. It is also the only species known from the Ethiopian region that lacks yellowish or leucine markings on the lateral margins of the pronotum.

Habitat data. Not known.

Etymology. The name *atra* (L., feminine), black, refers to the coloration of this insect.

Holotype. Macropterous male, COMORES ISL., Anjouan: Riv. Pomoni, oberlauf Anjouan, F/An 24, III-25-1974, F. Starmühlner (USNM). Paratypes. COMORES ISL., Anjouan: 1 female, same data as holotype (NHMW); 1 female, Matasamudu Riv., F/An 4, III-4-1974, F. Starmühlner (JTPC).

Rupisalda slateri, new species
Figs. 21, 36–38; map 3

Description. Of moderate size for genus, shape ovate, length 3.63 mm; maximum width (across hemelytra) 1.70 mm; ground color shining black, sparingly marked with dull white and dark yellow.

Head black, width/length 1.00/0.50, bearing 2 (1+1) small dark yellow spots on upper frons at bases of trichobothria, two (1+1) additional small ovate yellow spots along inner eye margins on either side of vertex; ocelli of moderate size, dark yellowish; eyes large, protrusive, dark red, width/length 0.28/0.43; frons and vertex covered with numerous fine semi-recumbent golden setae intermixed with a few longer erect golden setae on vertex; antennae slender, brown, covered with short recumbent golden setae, lengths of segments I–IV: 0.33, 0.73, 0.57, 0.53.

Pronotum black, width/length (midline) 1.60/0.40; lateral margins weakly convex, bearing 2 (1+1) elongate yellowish spots parallel to and adjoining central portions; small collar present, separated from remainder of anterior lobe by punctate sulcus; anterior lobe weakly tumescent, set off by curving punctate suture from broadly convex posterior lobe; posterior margin of posterior lobe broadly concave; surface of entire pronotum covered with short semi-recumbent golden setae. Scutellum black, shining, width/length 1.03/0.90; anterior lobe only weakly raised, separated from posterior lobe by sinuate sulcus, bearing shallow semicircular depression medially along posterior margin, posterior lobe domed, lateral margins flattened to form thin lip adjoining hemelytra; surface of both lobes covered with short semirecumbent golden setae.

Hemelytra black, shining; clavus length along outside margin 1.63, length of commissure 0.50, each side bearing a small yellow dot at extreme anterolateral angle, a small elongate dark yellow spot basally along inner margin and another roughly ovate yellowish spot next to commissure near apex, inner ⅔ of each side dull pruinose, set off from shining outer ⅓ by longitudinal row of punctations; corium with roughly circular dull pruinose spots centrally and posteriorly, each side bearing 3 elongate yellowish white spots inside of radial vein, these spots arranged longitudinally, relatively evenly spaced and paralleling outer margin of clavus, a single roughly circular bright white spot at base of embolar fracture, three additional small irregular yellowish white spots inside radial vein near tip of clavus; embolar margin with narrow dark yellow longitudinal stripe along basal ¾, this stripe narrowly interrupted by black posteriorly, then expanded into large dark yellow spot, this spot nearly confluent posteriorly with white spot at base of costal fracture; wing membrane fumate, lateral margin with narrowly triangular thickened dark yellow area extending from base to near apex, veins darker, forming 4 distinct closed cells; surface of clavus, corium embolium and thickened membranal area bearing numerous short semierect black setae.

Ventral surface of head, thorax and abdomen black, hypocostal ridge creamy white; rostrum brown, length 1.27, attaining middle coxae; entire ventral surface covered with short fine recumbent golden setae. Legs predominantly black on dorsal surfaces, with narrow annulations of yellowish white at bases and tips of femora and tips of tibiae, ventral surface of hind femora and tibiae mostly pale yellowish white, all tarsi brown; all leg segments covered with fine semierect golden setae, plus scattered erect black spines on fore, middle and hind tibiae; claws slender, gently curving, golden.

Male genitalia as in Figures 36–38.

Discussion. Rupisalda slateri most closely resembles *Rupisalda thika* Polhemus from Kenya, but differs from the latter by the rounded anterolateral angles of the pronotum which are wider than the head including eyes (vs. straight anterolateral angles narrower than head in *thika*), female hypocostal region (hr) feebly produced ventrally and not terminating abruptly (vs. produced into a lamina distally and terminating abruptly), female hr terminating at 0.70 of the distance from the base to the costal fracture (vs. 0.57), embolium dark at extreme basal angle (vs. light), and costal margin light along membrane beyond costal fracture (vs. dark in *thika*); compare figures 3A & B in J. Polhemus 1981 with Figure 21 in this paper.

Habitat data. This species has been found only on vertical rock surfaces, usually around waterfalls, in the wet east coast region of Madagascar. It was not common except at a waterfall 45 km west of Moramonga where it occurred in numbers on the vertical spray wetted rockface. Unfortunately the footing at this collecting site was so treacherous that our collections were limited.

Etymology. This patronym honors the outstanding contributions to entomology, especially hemipterology, by our esteemed colleague and friend, James Alexander Slater.

Holotype. Macropterous male, MADAGASCAR, Tananarive Prov.: waterfall, 45 km west of Moramonga along Tananarive highway below hydro plant, 1,097 m, CL 2252, XI-3-1986, J. T. & D. A. Polhemus (USNM).

Paratypes. MADAGASCAR, Tananarive Prov.: 2 males, 2 females, 1 nymph,

same data as holotype (JTPC, TSIM). Fianarantsoa Prov.: 1 female, Namarona River, 6 km west of Ranamofana, 900 m, CL 2249, X-31-1986, J. T. & D. A. Polhemus (JTPC); 2 females, Tamara Creek at Ambatolahy, 4.5 km west of Ranamofana, 884 m, CL 2251, X-31-1986, J. T. & D. A. Polhemus (JTPC).

Rupisalda vincenti, new species
Figs. 22, 39–41; map 3

Description. Large for genus, shape ovate, length 4.30–4.80 mm; maximum width (across hemelytra) 1.80–2.17 mm; ground color shining black, sparingly marked with white and dark yellow.

Head black, width/length 1.06/0.63, bearing 2 (1+1) small yellow spots on upper frons at bases of trichobothria, 2 (1+1) additional small ovate yellow spots present along inner eye margins on either side of vertex; ocelli large, pale grey; eyes large, protrusive, pale grey, width/length 0.30/0.57; frons and vertex covered with numerous fine semirecumbent golden setae intermixed with long erect black setae; antennae slender, brown, covered with short recumbent golden setae, lengths of segments I–IV: 0.37, 0.83, 0.60, 0.57.

Pronotum black, width/length (midline) 1.80/0.50; lateral margins weakly convex, bearing 2 (1+1) elongate yellowish spots parallel to and adjoining central portions; small collar present along anterior margin, separated from remainder of anterior lobe by punctate sulcus; anterior lobe tumescent, set off by curving punctate suture from broadly convex posterior lobe; posterior margin of posterior lobe broadly concave; surface of entire pronotum covered with semirecumbent golden setae intermixed with longer erect black setae. Scutellum black, shining, width/length 1.27/1.00; anterior lobe raised, separated from posterior lobe by sinuate sulcus, bearing semicircular depression medially along posterior margin; posterior lobe domed; surface of both lobes covered with semi-recumbent golden setae intermixed with longer erect black setae.

Hemelytra black, shining; clavus length along outside margin 1.83, length of commissure 0.50, each side bearing a small yellow dot at extreme anterolateral angle, a small elongate dark yellow spot basally along inner margin and another roughly ovate yellowish spot next to commissure near apex, inner ⅔ of each side dull pruinose, set off from shining outer ⅓ by longitudinal row of punctations; corium dull pruinose centrally and posteriorly, each side bearing 3 roughly ovate yellowish spots inside of radial vein, these spots arranged longitudinally, relatively evenly spaced and paralleling outer margin of clavus, a single roughly circular white spot at base of embolar fracture, other very slender yellow spots of variable size occasionally present just inside of and paralleling radial vein, and near apex of clavus; embolar margin uniformly yellowish white, this pale area occasionally confluent posteriorly with white spot at base of embolar fracture; wing membrane fumate, lateral margin with narrowly triangular thickened pale area extending from base to near apex, veins darker, forming 4 distinct closed cells; surface of clavus, corium and embolium bearing numerous long erect black setae.

Ventral surface of head and thorax black, abdomen and hypocostal ridge creamy white; rostrum brown, length 1.67, attaining hind coxae; entire ventral surface covered with short fine recumbent golden setae. Legs predominantly yellowish white

with following portions marked with brown: fore and hind coxae basally, distal ⅔ of fore femur, distal ⅓ of middle and hind femora, central portion of fore and middle tibiae plus narrow annulations at tips and bases, and entirety of tarsi on all legs; all leg segments covered with fine semierect golden setae, plus scattered erect black spines on fore, middle and hind tibiae; claws slender, gently curving, golden.

Male genitalia as in Figures 39–41.

Discussion. Rupisalda vincenti is apparently most closely related to *Rupisalda machadoi* Drake and *Rupisalda africana* Drake from Africa, the only two other *Rupisalda* species known from the Ethiopian Region with long dorsal setae. *Rupisalda africana* has a stridulatory mechanism consisting of a rastrate patch on the hind femur and serrate costal hemelytral margin, structures lacking in *R. vincenti. Rupisalda machadoi* has very long setae on the legs, especially noticeable on the hind tibia, whereas *R. vinventi* has only short setae on the legs, however the size, shape and coloration of these two species is quite similar.

Habitat data. This species is common and widespread in central, northern and eastern Madagascar, living on the steep rock surfaces of midstream boulders, and around cascades and waterfalls; it may occur also on Nosy-Be (Paulian, 1949).

Etymology. The name honors Dr. Vincent Razafimahatratra who has done much to advance the study of entomology in Madagascar, and who unselfishly gave his time and expertise to further our studies in that country; our research could not have succeeded without him.

Holotype. Macropterous male, MADAGASCAR, Tananarive Prov.: small waterfall and seeping rock face below the Queen's Palace, 1,310 m, CL 2233, X-24-1986, J. T. & D. A. Polhemus (USNM).

Paratypes (all collected by J. T. & D. A. Polhemus). MADAGASCAR, Tananarive Prov.: 47 males, 45 females, 28 nymphs, same data as holotype (JTPC, TSIM). Diego Suarez Prov.: 10 males, 11 females, 3 nymphs, small forest stream, 5 km N of Joffreyville, 488 m, CL 2281, XI-16-1986 (JTPC); 6 males, 6 females, 1 nymph, Mt. d'Ambre Forest Reserve, stream at Petite Cascade, 991 m, CL 2280, XI-15-1986 (JTPC); 4 males, 6 females, 1 nymph, Mt. d'Ambre Forest Reserve, stream at Grand Cascade, 671 m, CL 2278, XI-13-1986 (JTPC). Fianarantsoa Prov.: 1 male, 2 nymphs, roadside waterfall, 10 km S of Ambositra, 1,448 m, CL 2244, X-30-1986 (JTPC); 2 males, 7 km W of Ranomafana, 1,100 m, 1–7 November 1988, W. E. Steiner, from stream with mossy rocks and sandy bottom, montane rainforest (USNM).

KEY TO THE SPECIES OF *SALDULA* OF MADAGASCAR, MASCARENES
(Genus not known from the Comores)

1a. Basal ⅔ or more of clavus dark, without light markings 2
1b. Basal part of clavus not completely dark, with at least a small basal light colored streak or spot ..... *madagascariensis* Cobben
2a. Embolium leucine basally, usually completely leucine, but occasionally interrupted at distal ⅔ by a small dark fascia; outer corium predominantly leucine, often with two variably developed brownish regions medially ..... *niveolimbata* (Reuter)
2b. Embolium black or brownish basally; usually with a narrow to broad median dark area; outer corium predominantly dark 3
3a. Lateral margins of pronotum distinctly convex; embolium mostly leucine, narrowly black basally, usually with narrow to broad median blackish area; outer corium black,

basally and often distally lighter, with contrasting subdistal ovate white spot .....
.....*ornatula* (Reuter)

3b. Lateral margins of pronotum straight; embolium not predominantly leucine, broadly brownish basally, with a broad brown area at distal ⅔; outer corium brownish, basally lighter, with small median and subdistal irregular light areas, but without subdistal ovate white spot ..... *subcarinata* (China)

Saldula madagascariensis Cobben
Figs. 16–18; map 4

Saldula madagascariensis Cobben, 1987. Revue Zool. Afr. 100:417. Type, female, Isalo, Madagascar, in Muséum National d'Histoire Naturelle, Paris.

Additional description. See Cobben (1987a, pp. 417–419, fig. 6) for original description and habitus of light form; only additional details given here. Coloration of dark form: Head with light markings reduced, only elongate preocellar spots (1+1) and small lateral spots (1+1) on frons light, remainder of vertex and frons black. Pronotum with light stripe on humeral margins only weakly indicated, brown. Hemelytra with embolium leucine, interrupted at distal ⅔; inner and outer corium with lightest areas (as shown by Cobben, fig. 6) frosted white, remainder brown, veins black; clavus with basal light spot set in pruinose area, distal elongate spot brown except frosted white on distal extreme. Legs, basal segment of antennae leucine to testaceous, antennae dark on distal 3 segments, segment IV light medially.

Small male: length 2.66, width 1.30. Head width 0.93; length 0.48; minimum interocular space 0.19; eye length 0.48, width 0.37. Length visible rostral segments I–III: 0.11, 1.00, 0.48. Length antennal segments I–IV: 0.30, 0.52, 0.44, 0.54. Pronotum length 0.81; posterior width 1.04, anterior width 0.63, across collar 0.56. Scutellum length (visible) 0.59; width 0.59. Hemelytra: corium length 1.74, clavus length 0.81, length claval commissure 0.37, distance apex claval commissure-apex membrane 0.85. Length of legs: metafemur 0.89, metatibia 1.41. Male genital structures as shown in Figures 16–18.

Discussion. We have seen this species from a number of localities. It lives on horizontal to sloping rock surfaces where there are permanent seeps. On Mt. d'Ambre we found it in the mouth of a shallow cave where ceiling drip and seeps maintained damp rocks interspersed with mosses.

There is considerable variation in coloration so that at first it appeared that two species were present, however all structures were identical in these forms and there are intergrades in coloration in the same population. The lightest form is the one figured by Cobben (1987a: fig. 6), with fasciae near the posterolateral angles of the pronotum, acetabulae anteriorly light and abdominal ventrites yellowish. In the darkest form, all of these structures are black to blackish brown. Cobben described this species from a single damaged female so we have added some details here and figure the male genitalia.

Material examined. MADAGASCAR, Diego Suarez Prov.: 8 males, 8 females, 12 nymphs, Mt. d'Ambre Forest Reserve, stream at Petite Cascade, 991 m, CL 2280, XI-15-1986 (JTPC, TSIM). Fianarantsoa Prov.: 1 female, Namarona River, 6 km W of Ranomafana, 900 m, CL 2249, X-31-1986 (JTPC). Tamatave Prov.: 4 males, 2 females, 2 nymphs, rocky stream 33 km E of Moramanga on Tamatave Hwy., 825

m, CL 2254, XI-3-1986 (JTPC); 1 male, streamlet 52 km W of Brickaville on Tamatave Hwy., 183 m, CL 2258, XI-4-1986 (JTPC); 2 males, 6 females, Ampasimbe River, 80 km E of Moramanga on Tamatave Hwy., 198 m, CL 2263, XI-5-1986 (JTPC).

Saldula niveolimbata (Reuter)
Map 4

Acanthia niveolimbata Reuter, 1900. Bull. Soc. Entomol. Fr. 1900:156. Type, sex unknown, Senegal, repository unknown (Montandon Coll.?).
Saldula niveolimbata Drake & Hoberlandt, 1951. Acta Entomol. Mus. Nat. Pragae 26(376):8.

Discussion. Cobben (1987a, p. 419) listed this species from Madagascar on the basis of material from the Leningrad Museum taken along with *Saldula ornatula* (Reuter) in Tananarive Province. We have seen a single additional specimen from Fianarantsoa Province. This widespread species occurs also on the granitic Seychelles, as well as Africa, Asia, Australia and Samoa.

Material examined: MADAGASCAR, Fianarantsoa Prov.: 1 male, 7 km W of Ranomafana, 1,100 m, 22–31 October 1988, W. E. Steiner, from flight intercept-yellow pan trap in Malaise trap in small clearing, montane rainforest (USNM).

Saldula ornatula (Reuter)
Map 4

Acanthia ornatula Reuter, 1881. Berl. Entomol. Zeitschr. 25:160. Type, sex unknown, Egypt, in Swedish Natural History Museum, Stockholm.
Saldula ornatula Drake & Hoberlandt 1951. Acta Entomol. Mus. Nat. Pragae 26(376):9.

Discussion. This species was present on seeps on an open sunny exposed rock face below the Queen's Palace in Tananarive, but it was not abundant and was difficult to collect. We did not see it on the open exposed shores of ponds or streams elsewhere, although in other regions the preferred habitat seems to be muddy shores. We expect *ornatula* to be found eventually on the Comores and Mauritius, as it is widespread in Africa and Asia, and previously listed from Madagascar by Drake (1960).

Material examined. MADAGASCAR, Tananarive Prov.: 2 males, 4 females, 3 nymphs, small waterfall and seeping rock face below the Queen's Palace, 1,310 m, CL 2233, X-24-1986, J. T. & D. A. Polhemus (JTPC, TSIM). REUNION: 3 males, 7 females, 1 nymph, Cilaos, XI-17-1990, E. Heiss (JTPC).

Saldula subcarinata (China)
Fig. 50

Acanthia (Saldula) subcarinata China, 1924. Ann. Mag. Nat. Hist. (9)14:447. Type, female, Rodriguez, in British Museum (Natural History), London.
Saldula subcarinata Drake & Hoberlandt, 1951. Acta Entomol. Mus. Nat. Pragae 26(376):10.

Discussion. This poorly known species is apparently endemic to the isolated island

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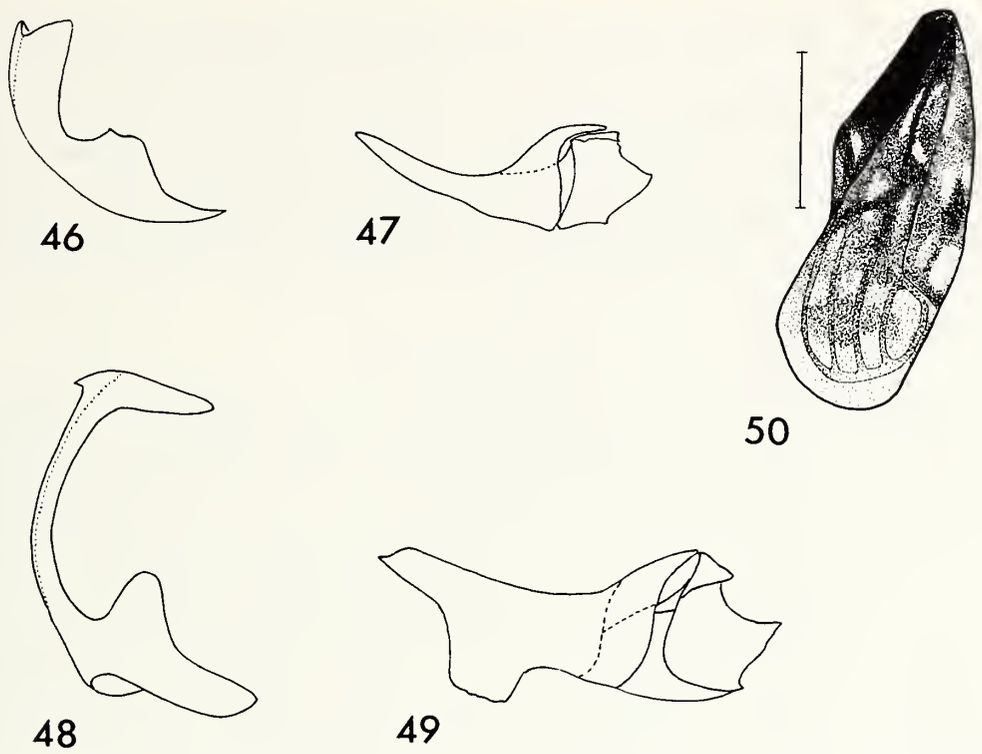

Figs. 46–50. Saldidae. 46–49. Genitalic structures, endosoma. 46–47. *Capitonisaldoida cryptica.* 46. Endosomal sheath. 47. Apicolateral sclerites, side view. 48–49. *Capitonisalda aethiopica* (Carlini), Malawi. 48. Endosomal sheath. 49. Apicolateral sclerites, side view. 50. *Saldula subcarinata,* hemelytra. (Figs. 46–49, courtesy Per Lindskog.)

of Rodriguez. One of us (JTP) has examined the female holotype, which is so far the only known specimen. China's description is adequate, and the species clearly belongs to the genus *Saldula.* It may be separated from its congeners by the distinctive hemelytral pattern (Fig. 50).

Salduncula seychellensis Brown
Fig. 15; map 3

Salduncula seychellensis Brown, 1954. Ann. Mag. Nat. Hist. (12)7:855. Type, female, Mahé, Seychelles, in British Museum (Natural History), London.

Discussion. We have before us a number of specimens from the Seychelles, and a pair from Madagascar. These are in general agreement as stated by Brown (1960). Brown (1954) had only the unique female type from the Seychelles, however he (Brown, 1960) later figured the male paramere of a specimen from Madagascar [a record overlooked by both Polhemus (1981) and Cobben (1987b) in preparing their checklists of African Saldidae]. The junior author has collected several long series on Aldabra Atoll, and a shorter series on Cosmoledo Atoll. With this additional material available from the Seychelles and the atolls of the Aldabra group we have been able to confirm the agreement of the male genitalia and other characteristics

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Figs. 42–45. Saldidae, genitalic structures, endosoma. 42–43. *Capitonisaldoida cryptica.* 42. Side view. 43. Median sclerites, dorsal view. 44–45. *Capitonisalda sp.* 44. Side view. 45. Median sclerites, dorsal view. (Figs. 42–45, courtesy Per Lindskog.)

among these disjunct populations. In males from the Seychelles the filum gonopori is coiled slightly more than 2 times. The parameres of males from both Madagascar and the granitic Seychelles (Fig. 15) are of a slightly different shape but much more hirsute than the paramere figured by Brown (1960: fig. 1C). The endosomal sclerites are typical of the Saldinae. The hemelytral markings of specimens from a single series encompass the variation illustrated by Brown (1960: fig. 1A, B) confirming Brown's assessment that there are not even subspecific differences between the Madagascar and the Seychelles populations.

The nymphs have small widely separated dorsal scent gland openings (1+1) and a well developed larval organ situated slightly more medially than most Saldinae.

Habitat. This genus lives on intertidal rocks, secreting itself in pockets and crevices when disturbed or submerged by rising tide waters (see also Paulian, 1959). On Aldabra Atoll this species was found only on the south and east coasts, which receive heavy wave action from the southeast monsoon and lack an offshore reef crest (D. Polhemus, 1990). A diligent search of suitable intertidal rocks in the Mascarenes and Comores should reveal the presence of this species there also. In the Malay Archipelago (Singapore, Sabah) this species is replaced by other undescribed species that live in similar situations (J. Polhemus, 1991).

Material examined. MADAGASCAR, Majunga Prov.: 1 male, 1 female, Nosy-Be, Pointe á la Fievre, récife corallien, R. Paulian (JTPC). SEYCHELLES, Mahé: 1 male, 3 females, Bean Valley Bay, on rock, HWM, VIII-20-1985, L. Cheng (JTPC). St. Anne Is.: 4 males, 10 females, 27 nymphs, among small barnacles on boulders, HWM, VIII-19-1985, L. Cheng (JTPC). ALDABRA ATOLL, Grande Terre Is.: 9 males, 7 females, 45 immatures, rocky coast at Cinq Cases, low tide, 1500 hr, 13 March 1989, CL 8030, D. A. Polhemus (USNM, JTPC); 21 males, 10 females, 22 immatures, rocky coast at Dune Jean Louis, 9°27′16″S, 46°23′70″E, low tide, 1230–1430 hr, 24 March 1989, CL 8040, D. A. Polhemus (USNM, JTPC). COSMOLEDO ATOLL, Menai Is.: 1 female, 8 immatures, rocky coast at Johannes Point settlement site, 9°41′68″S, 47°32′26″E, low tide, 1100 hr, 27 March 1989, CL 8041, D. A. Polhemus (USNM).

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